Exploring the Public Health Practitioner's Alliance with the Laboratory

Governor’s Public Health Conference

May 2007

Objectives

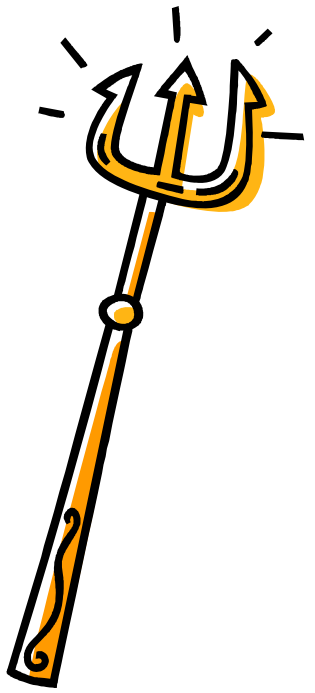
At the end of this presentation, participants will be able to:

- Describe the role of the laboratory in public health
- Determine when laboratory testing is necessary
- Understand when they can utilize the state public health laboratory

The Basics

3-pronged approach

- Investigation of infectious diseases, particularly outbreaks, involves a 3-pronged approach:
  - Epidemiology investigation
  - Laboratory investigation
  - Environmental investigation



3-pronged approach, cont.

- Epidemiology: Determines likely agents & implicated source of infection; drives lab testing
- Laboratory: Tests specimens & samples; identifies agents & implicated source
- Environment: Performs environmental assessment of facility, area; collects samples for testing

Case Definitions—Speaking the same language

- Case definitions provide standard way of describing illness, classifying cases
- 3 kinds of case definitions
  - Clinical case definitions
  - Public health surveillance case definitions
  - Outbreak case definitions
- Lab support critical component of almost all case definitions

Example Case Definition

Salmonellosis *(Salmonella spp.)* 2005 Case Definition

- **Clinical description**
  - An illness of variable severity commonly manifested by diarrhea, abdominal pain, nausea, and sometimes vomiting. Asymptomatic infections may occur, and the organism may cause extraintestinal infections.
- **Laboratory criteria for diagnosis**
  - Isolation of *Salmonella* from a clinical specimen

Example Case Definition, cont.

- **Case classification**
  - *Probable*: a clinically compatible case that is epidemiologically linked to a confirmed case.
  - *Confirmed*: a case that meets the laboratory criteria for diagnosis. When available, O and H antigen serotype characterization should be reported.
- Both asymptomatic infections & infections at sites other than gastrointestinal tract, if laboratory confirmed, are considered confirmed cases that should be reported

Chain of Infection

Rapid accurate identification of organisms

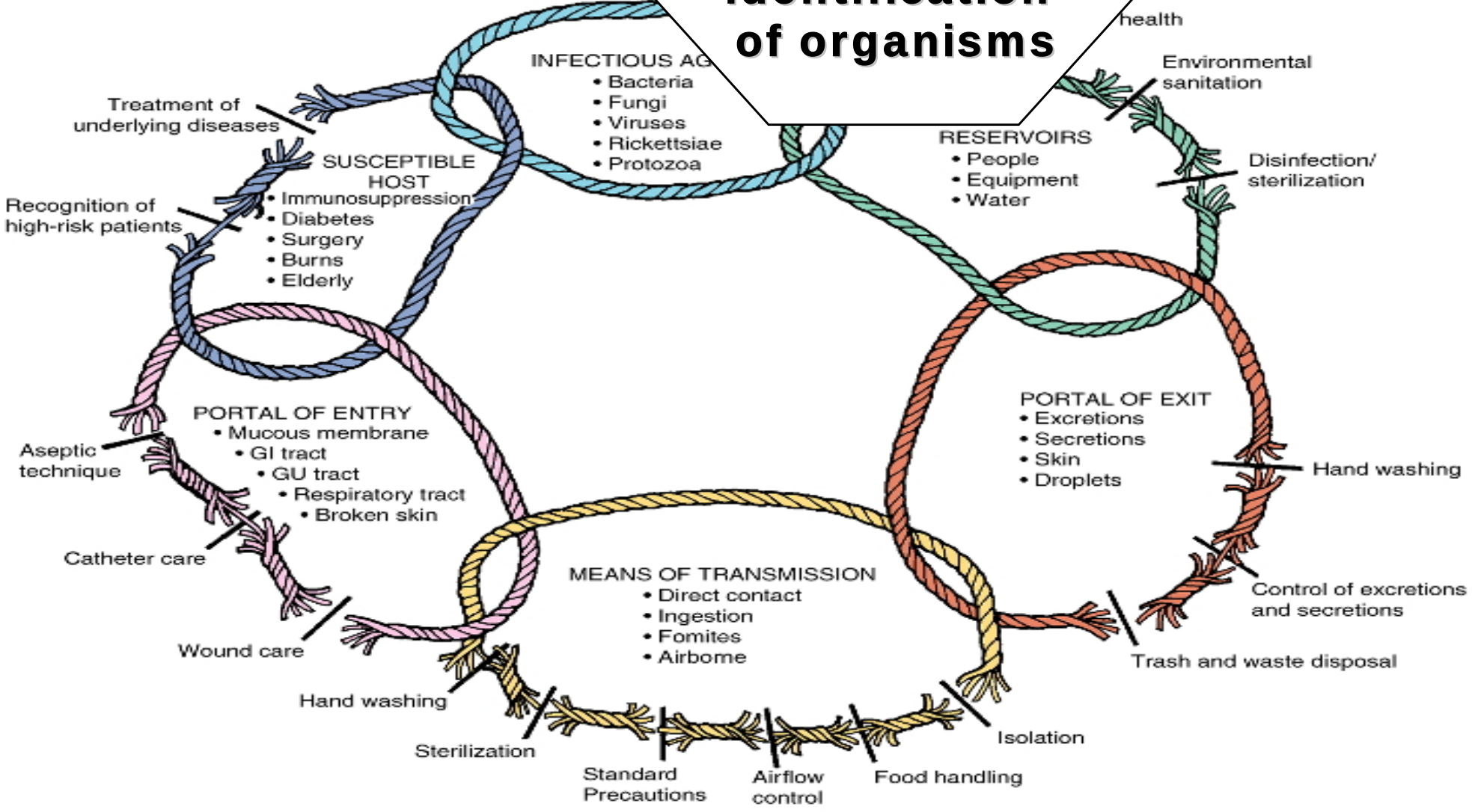


Figure 70-1 Health care workers' interventions used to break the chain of infection transmission.

Why Public Health Needs the Lab

- Confirms a “disease” or “outbreak” that can be controlled
  - Suspect case of measles
  - Suspect case of pertussis
  - Cluster of gastrointestinal illness

Why Public Health Needs the Lab

- Confirms a “situation” or “illness” that can be prevented
  - Phenylketonuria (PKU) in newborn
  - Lead in environment poisoning a child
  - Pregnant female exposed to varicella

Why Public Health Needs the Lab

- Policy and decision making
  - Boil water order
  - Recall of contaminated greens
  - Release of a TB case from isolation
  - No smoking areas

Why Public Health Needs the Lab

- To “observe” or “monitor” a situation
  - Nitrogen level in a Kansas river
  - Persons exposed to a chemical incident

Laboratory Communication

How they “report” to you

Lab Terms

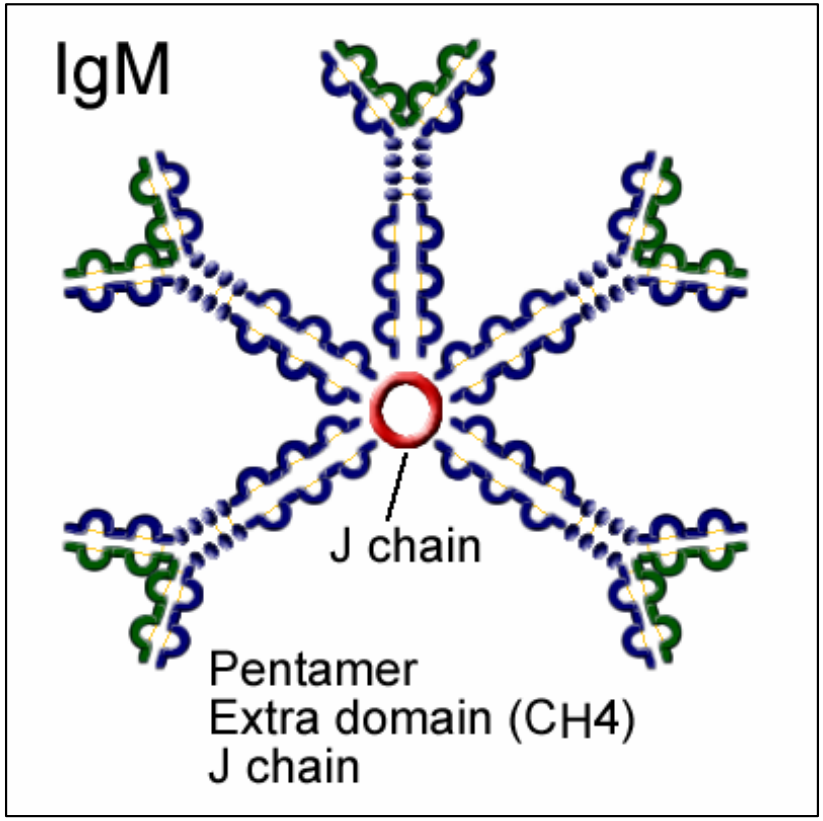
- Antigen, antibody
- Rapid tests
- Serogroup, serotype
- PCR
- PFGE pattern
- Reference Ranges, Interpretive Criteria
- Specimen, sample

Antigen vs. Antibody

- Antigen: stimulates production of antibodies
  - "Anti^body Gen^erator"
- Antibody: produced in immune response to fight foreign antigens
  - Various immunoglobulin types
  - Formed at different times for different reasons

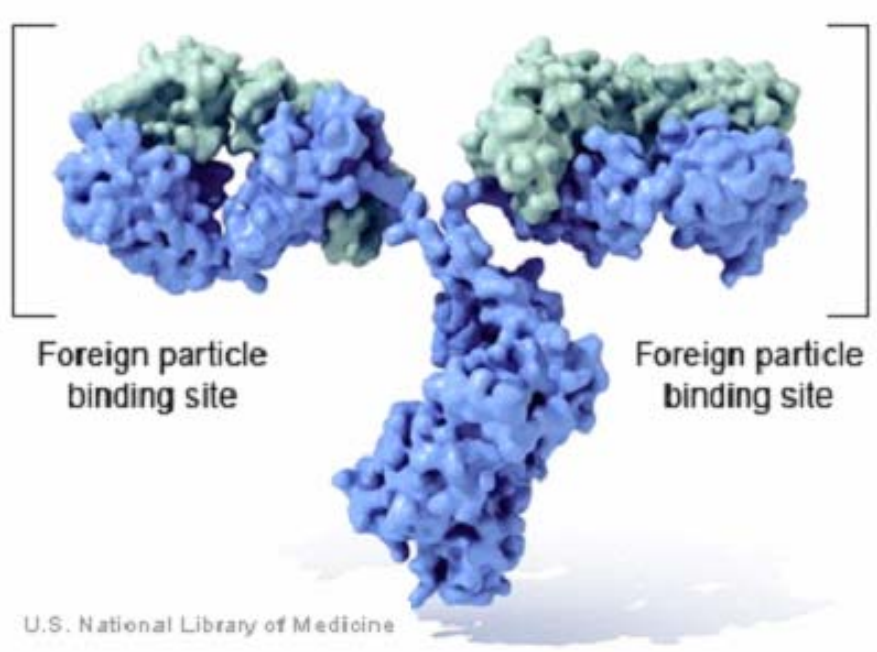
Antibody: IgM (Immunoglobulin M)

- Early in immune response
- Marker of acute infection



Antibody: IgG (Immunoglobulin G)

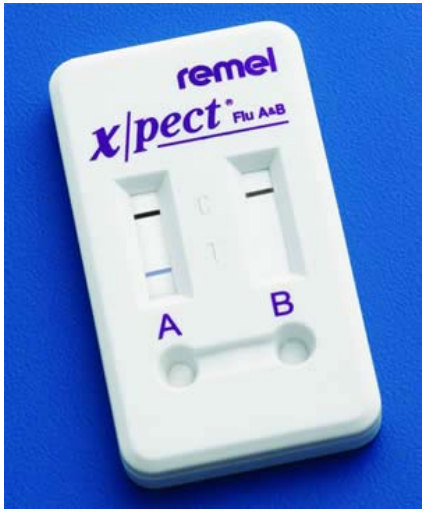
- A.K.A. Gamma Globulin
- Usually rise later
  - Marks past infection
  - May mark immunity to agent



Immuoassay vs. Culture

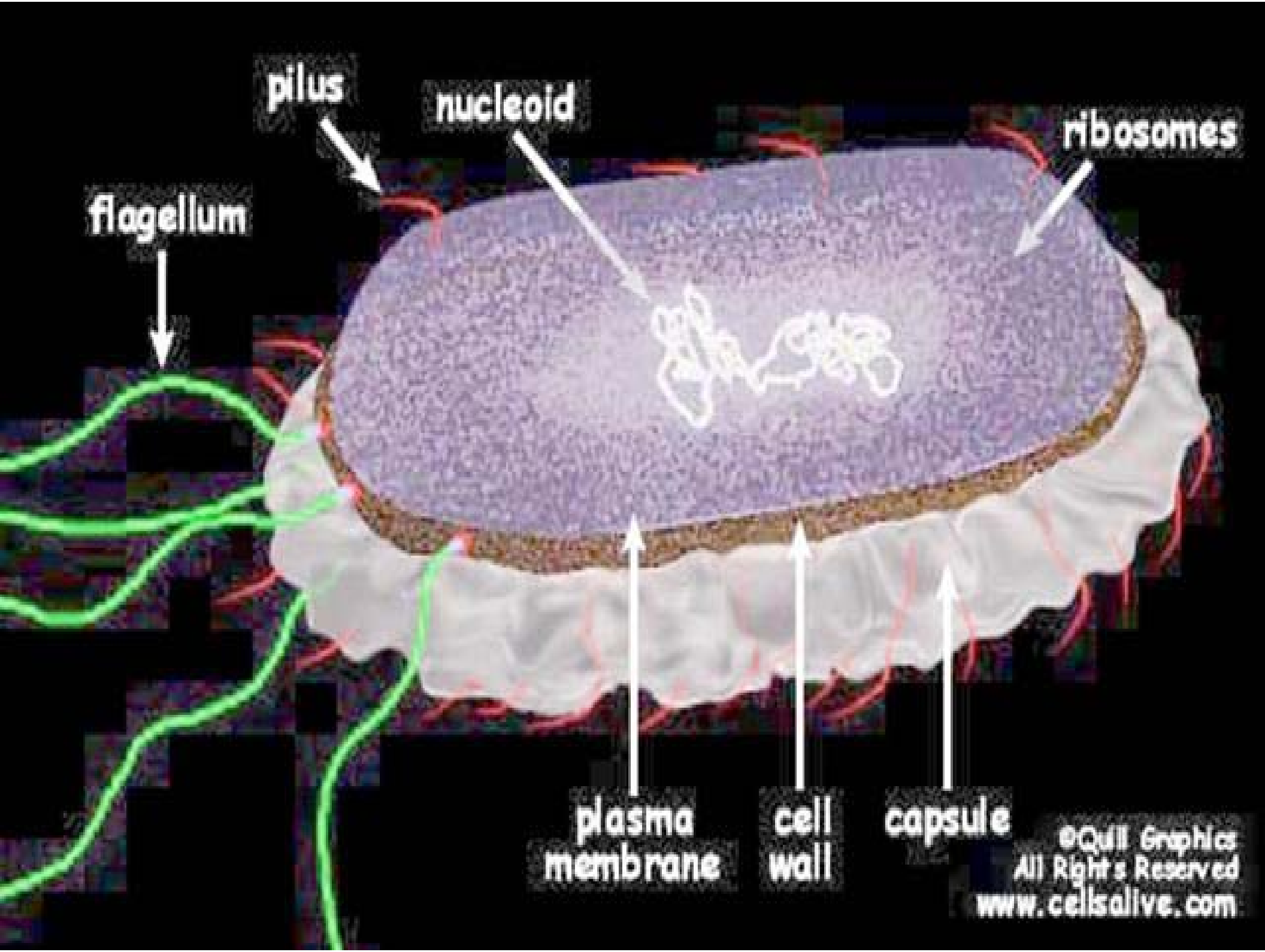
- Immuonassay: detection of antigens or antibodies to indicate past or present infection with a microorganism
  - Use to detect infection, follow course of disease or determine immune status
  - Qualitative and quantitative
- Culture: detection of pathogenic microorganism by growing it in a suitable media
  - Indicates present infection or colonization
  - Depends on organisms ability to grow

Rapid Testing Kits



Serogroup

- Group of microorganisms with same antigens
- May contain more than one serotype
- Ex: *Salmonella enterica* Serogroup B


pilus
nucleoid
ribosomes
flagellum
plasma membrane
cell wall
capsule
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Serotype

- A.K.A. Serovar
- Method of classifying bacteria, viruses based on surface antigens
- Useful for epi investigations
- Ex: *Salmonella* has more than 4400 serovars
  - *Salmonella enterica* serovar Tennessee

Salmonella Naming Conventions

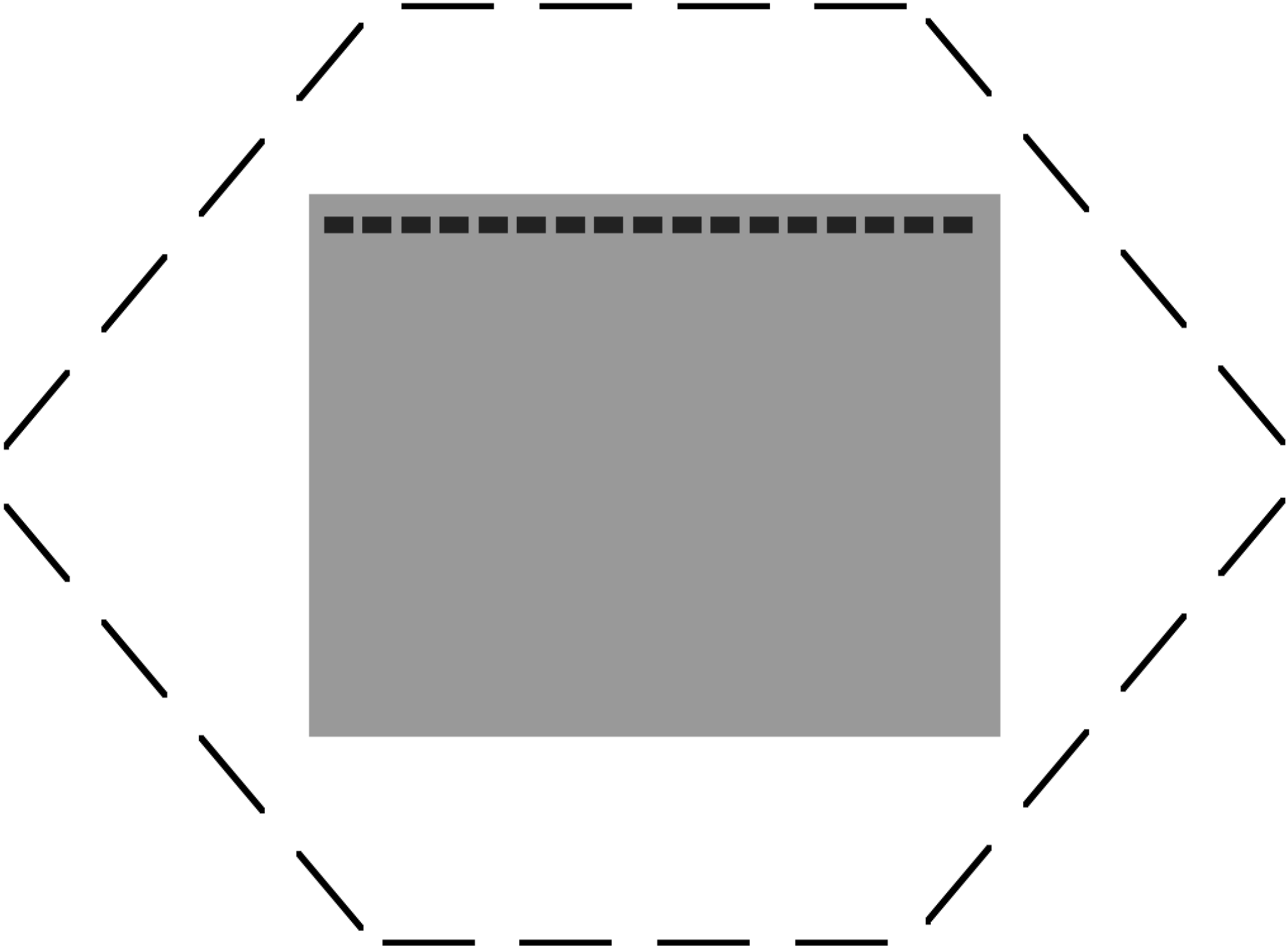
Genus	→	*Salmonella*
Species	→	*enterica*
Subspecies	→	*enterica*
Serogroup	→	Group B
Serotype	→	Heidelberg

PCR

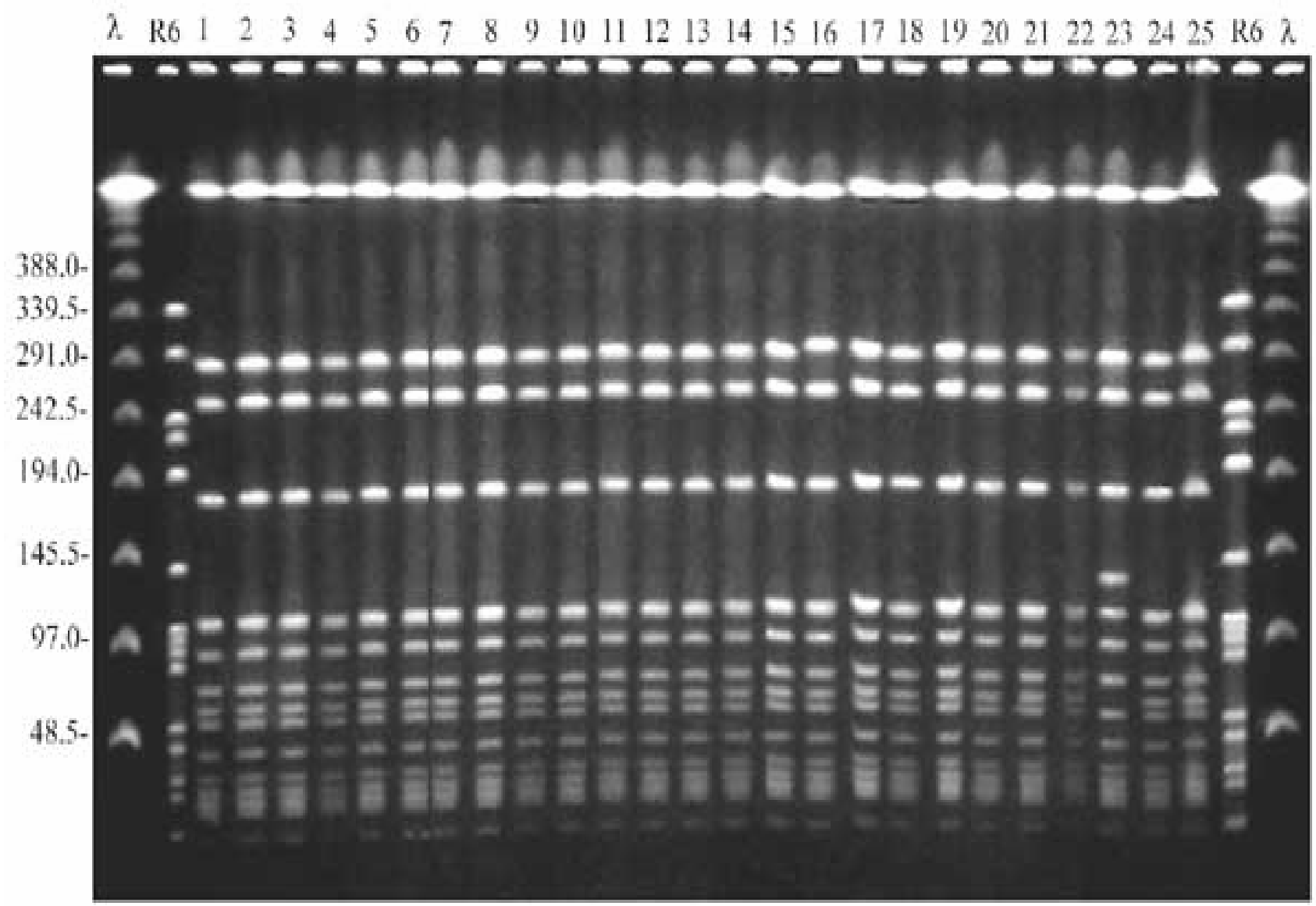
- PCR is rapid assay
- Viable specimen is not required
- PCR is highly specific
- No special media required
- http://highered.mcgraw-hill.com/olc/dl/120078/micro15.swf

PFGE

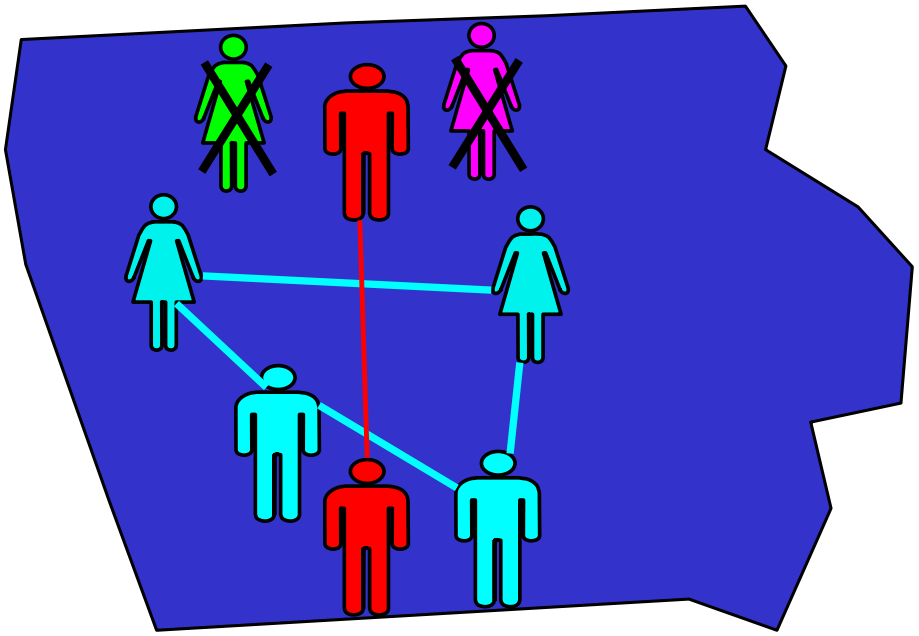
- Pulsed- field Gel Electrophoresis
- Used for genetic fingerprinting
- Practical application in cluster detection & outbreak association



PFGE Gel—MRSA



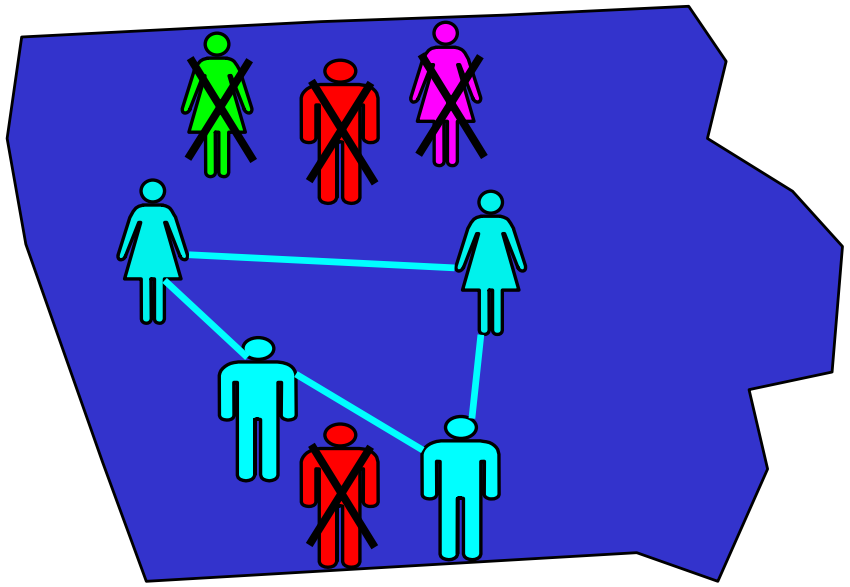
Cluster Detection Tool



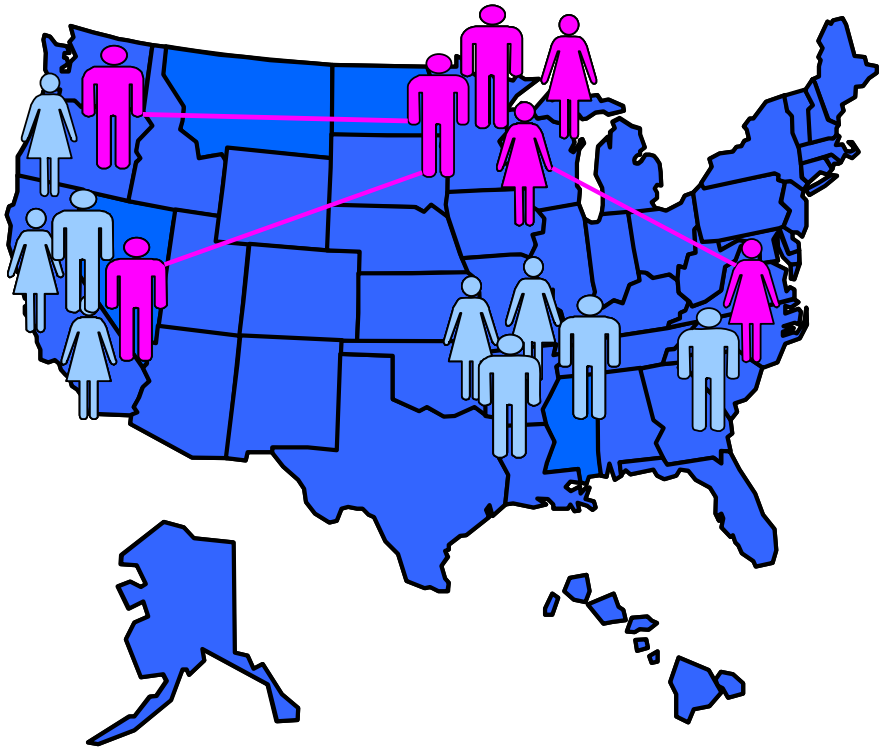
- Clusters detected through surveillance
- Interview cases
- Find epi link to isolates with same subtype
- Works best with real-time subtyping AND real-time epi

Outbreak Investigation Tool

- Differentiate outbreak cases vs. sporadic cases
- Focus outbreak investigation
- Can help identify outbreak vehicle



Linking Sporadic Cases to Outbreaks



- Single cases from different states often help solve outbreaks

Reference Ranges

- What do the results mean

```
HCV MONITOR TEST
SOURCE: PCR
STARTED: 05/14/05
---------------------------- FINAL REPORT -----------
05/14/05 1721
HCV RNA QUANTITATIVE ASSAY BY PCR
-----------------------------------------------------
489,000 IU/ML   (REFERENCE RANGE: NONE DETECTED)
LOG 10 = 5.69
NOTE:  THE LINEAR RANGE OF THIS ASSAY IS 10 IU/ML -
20,000,000 IU/ML
-----------------------------------------------------
```

Interpretive Criteria

- How are the results used

UTAH STATE DEPT OF HEALTH
ATTN: COMMUNICABLE DISEASES
46 NORTH MEDICAL DRIVE
SALT LAKE CITY, UT 84017

ACCESSION #:

COLLECTED: 04/12/2006 15:14

RECEIVED: 04/15/2006 10:20

REPORTED: 04/19/2006

PATIENT:
SEX: F AGE: 18
ACN #: 11833
SOURCE: SERUM

DOB: 12/17/1987

FINAL REPORT
Reprint Date: 04/19/2006
Reprint Time: 15:01

Ordering Client:
A.R.U.P.

TOXIC SHOCK SYNDROME ANTIBODY PANEL, MAID

TSST-1 ANTIBODY	POSITIVE
SEB ANTIBODY	POSITIVE

REFERENCE RANGE: NEGATIVE

Interpretive Criteria, cont.

- How are the results used

TOXIC SHOCK SYNDROME ANTIBODY PANEL, MAID

TSST-1 ANTIBODY	POSITIVE
SEB ANTIBODY	POSITIVE

REFRENCE RANGE: NEGATIVE

INTERPRETIVE CRITERIA:
NEGATIVE - Anitibody not detected
POSITIVE - Antibody detected

Toxic shock syndrome (TSS) is associated with strains of Staphylococcus aureus that produce TSS toxin-1 (TSST-1) and/or staphylococcal enterotoxin B (SEB). TSST-1 is associated with approximately 65% of TSS cases, whereas SEB is associated with approximately 20% of cases. Individuals lacking antibodies to TSST-1 or to SEB (approximately 10% and 20% of adults, respectively) are presumed to be at highest risk of TSS. This test is thus designed to identify antibody-negative individuals at risk for TSS; it should not be used as a tool for diagnosing TSS.

Specimen vs. Sample

- Specimen
  - Refers to fluid, tissue, urine, etc. collected for diagnostic purposes
  - Usually refers to substances gathered from humans
- Sample
  - Small part intended to represent whole
  - Usually refers to inanimate objects, such as food

The Practical Side of Things

When to Test—Specimens

- Testing described in case definition isn't performed in private labs
- Control measures needed & lab testing not done privately
- Persons symptomatic & associated with outbreak
  - Can test persons associated with outbreak have recently recovered

Determining Association with Outbreak

- Persons have similar symptom clusters
  - Ex: nausea, vomiting diarrhea
  - Captured by outbreak case definition
- Persons have similar duration of illness
  - Or determined to be secondary cases

Determining Association with Outbreak, cont.

- Persons became ill in similar timeframe
- Person indicates some association with other ill individuals
  - Ex: consumed same brand of cheese, attended same wedding reception

When to Test—Samples

- Epidemiological association implicates
  - Particular food item, ingredient
  - Common source of water
  - Common environmental surface
- Feasible, cost-effective form of testing exists
- Testing will add to knowledge

What to Test—Specimens

- Will depend on
  - Symptoms
  - Mode of transmission
  - Surveillance Case definition

What to Test—Samples

- Will depend on
  - Agent isolated in specimens
  - Mode of transmission
  - Symptoms

Task List—Specimens

1. Obtain specimen collection kits
2. Collect clinical specimens from ill, recently ill cases
3. When appropriate, notify ESS/laboratory of specimen submission
4. Submit specimen via courier, other

Task List—Samples

1. Identify implicated environmental item
2. Talk to the experts
3. Coordinate sample collection
4. When appropriate, notify ESS/laboratory of sample submission
5. Submit sample via courier, other

Stool Specimen Collection

- Tips and tricks for collection (or explaining collection)
  - Don’t pass stool directly into

Chain of Custody

- Part of preparedness
- May also be useful if litigation occurs
  - E.g. drug testing kits
- Chain of Custody forms can vary by agency
- Most include:
  - Sample/specimen information (source, condition)
  - Collecting/submitting entity info (contact info)
  - Internal & external transfer information

Chain of Custody, cont.

- Purpose: Chronological, written record of specimen/sample
- Assures accountability for life of specimen/sample
- Considered confidential document

The Real World

Examples of public health working with the laboratory

Recent National Outbreaks

Real World

Could there be improvements

Straight from the Laboratorians's Mouth

- The amazing, exploding stool kit!
- Playing peek-a-boo with swabs
- Is it crowded in here, or is it just me?
- Shhh, we're in disguise
- Feeling down trodden?

Culture Confirmation of Shiga Toxin-producing *Escherichia coli*

- MMWR articles on STEC outbreaks and impact of EIA testing done privately
  - New York – assessed with rapid outbreak identification
  - North Carolina – false positive results resulted in unnecessary control measures
  - Virginia – false positive results and inappropriate response

Resources

- Surveillance Case Definitions: http://www.cdc.gov/epo/dphsi/casedef/case_definitions.htm
- KDHEL packing & shipping resources: http://www.kdheks.gov/labs/packaging_and_shipping.html

Questions?